Put $\sqrt{-1}=i$; then $-1=i^2$, and $-i^i=i^2.i^i=i^{i+2}$....(2).

In (1), putting $a=i$, $n=i+2$, gives $i^{i+2}=e^{(i+2)\log i}$ ....(3).

But $\log i=(2n\pi+\frac{1}{2}\pi)i$....(4); then (3) is, with $n=0$,

$$i^{i+2}=e^{(i+2)(\frac{1}{2}\pi)i}=e^{(i-\frac{1}{2})\pi}.$$

II. Solution by J. W. YOUNG, Oliver Graduate Scholar in Mathematics, Cornell University, Ithaca, N. Y.; GEORGE LILLEY, Ph. D., LL. D., Professor of Mathematics, State University, Eugene, Ore.; and HARRY S. VANDIVER, Bala, Pa.

Since $\cos\theta+i\sin\theta=e^{i\theta}$ $[i=\sqrt{-1}]$ we have $i=e^{i\frac{1}{2}\pi}$, $i^i=e^{-\frac{1}{2}\pi}$, $-i^i=e^{i\pi}.e^{-\frac{1}{2}\pi}$.

$$\text{or } -(\sqrt{-1})^{\sqrt{-1}}=e^{(\sqrt{-1}-\frac{1}{2})\pi}.$$

III. Solution by CHARLES PURYEAR, Department of Mathematics, Agricultural and Mechanical College, College Station, Texas.

$$e^x=1+x+\frac{x^2}{2\,!}+\frac{x^3}{3\,!}+\frac{x^4}{4\,!}+\ldots.(1).$$

$$e^{-x}=1-x+\frac{x^2}{2\,!}-\frac{x^3}{3\,!}+\frac{x^4}{4\,!}-\ldots.(2).$$

$$\therefore e^x+e^{-x}=2(1+\frac{x^2}{2\,!}+\frac{x^4}{4\,!}+\ldots.)\ldots.(3).$$

Replacing x by ix where $i=\sqrt{-1}$,

$$e^{ix}+e^{-ix}=2(1-\frac{x^2}{2\,!}+\frac{x^4}{4\,!}+\ldots.)\ldots.(4), \text{ or } e^{ix}+e^{-ix}=2\cos x\ldots.(5).$$

Let $x=\pi$, then $e^{\pi i}+e^{-\pi i}=-2$....(6).

Solving, $e^{\pi i}=-1$....(7).

Extracting the square root of each member of (7), $e^{(\frac{1}{2}\pi)i}=i$....(8).

Raising each member of (8) to the power of i, $e^{-\frac{1}{2}\pi}=(i)^i$ ...(9).

Multiplying (7) and (9), $e^{(i-\frac{1}{2})\pi}=-(i)^i$.

Also solved by *J. SCHEFFER*, *H. C. WHITAKER*, and *G. B. M. ZERR*.

94. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

The wall of a house, if its plane were extended, would cut the horison at an angle$=\beta°$ south of the true east point. The latitude of the place being$=\phi$, and the declination of the sun$=\delta$. When will the sun cease to shine through a window in that wall?

Solution by H. C. WHITAKER, A. M., Ph. D., Professor of Mathematics, Manual Training School, Philadelphia, Pa.

When the sun does not shine in the window its azimuth is $270°+\beta$. Let P be the pole, Z the zenith, and S the sun; then $PZ=co-\phi$, $PS=co-\delta$, angle $Z=90°+\beta$.

Therefore, by spherical trigonometry, $\sec\phi\tan\beta\sin P-\tan\phi\cos P=-\delta$.

$$\sin P=\frac{-\sec\phi\tan\beta\tan\delta\pm\tan\phi(\sec^2\phi\tan^2\beta+\tan^2\phi-\tan^2\delta)^{\frac{1}{2}}}{\sec^2\phi\tan^2\beta+\tan^2\phi}.$$

The time A. M. $=12-P^\circ/15^\circ$.

Also solved by *G. B. M. ZERR*, and *J. SCHEFFER*.

95. Proposed by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio State University, Athens, Ohio.

"I enjoy here," said Goethe, "both good days and good nights. Often before dawn I am already awake, and lie down by the open window to enjoy the splendor of the three planets, which are at present to be seen together, and to refresh myself with the increasing brilliancy of the morning red," This was written in the summer of 1828 near Weimar. See Goethe's "Conversations with Eckermann," Bohn's Library, 1898, page 323.

What three planets are referred to ?

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

We will only cônsider Mercury, Venus, Mars, Jupiter, and Saturn, as Uranus and Neptune are too faint to reveal any splendor. The event would happen soon after conjunction.

Mars and Sun were in conjunction January 16, 1900.

Jupiter and Sun were in conjunction November 13, 1899.

Saturn and Sun were in conjunction December 29, 1900.

Venus and Sun were in conjunction inferior July 4, 1900.

Mercury and Sun were in conjunction superior February 9, 1900.

Synodic period of Mars, 780 days ; of Jupiter, 399 days ; of Saturn, 378 days ; of Venus, 584 days ; of Mercury, 116 days.

From July 1, 1828, to January 16, 1900, are 26132 days. $26132\div780=33$ and 392 days over. Therefore the conjunction of Mars and the Sun happened 392 days after July 1, 1828, and so Mars was not one of the three planets.

From July 1, 1828, to November 13, 1899, are 26068 days. $26068\div399=65$ and 133 days over. Therefore Jupiter could not have been one of the three planets.

From July 1, 1828, to December 29, 1900, are 26479 days. $26479\div378=70$ and 19 days over. Therefore the conjunction of Saturn and the Sun happened only 19 days after July 1, 1828.

From July 1, 1828, to July 4, 1900, are 26301. $26301\div584=45$ and 21 days over. Therefore the conjunction of Venus (inferior conjunction) happened only 21 days after July 1, 1828.

From July 1, 1828, to February 9, 1900, are 26156 days. $26156\div116=225$ ans 56 days over. Therefore superior conjunction of Mercury and the Sun happened 56 days after July 1, 1828. Thirty-six days days previous to this or 20 days after July 1, 1828, Mercury was at greater elongation and therefore nearly as bright as Sirius.

Therefore Mercury, Venus and Saturn are the three planets referred to and the time the latter part of July.